

GB 2336383 A

UK Patent Application GB 2 336 383 A⁽¹³⁾

FIG. 4

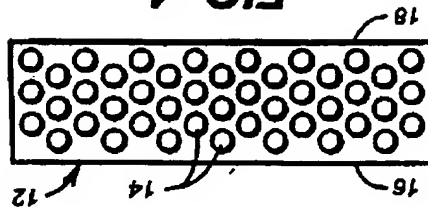


FIG. 2

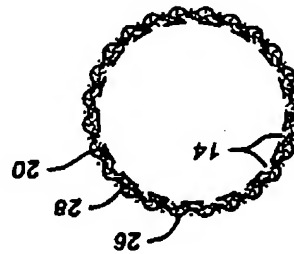


FIG. 3

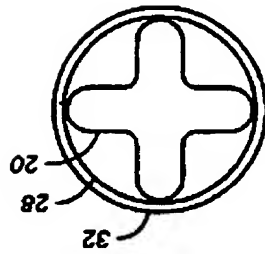
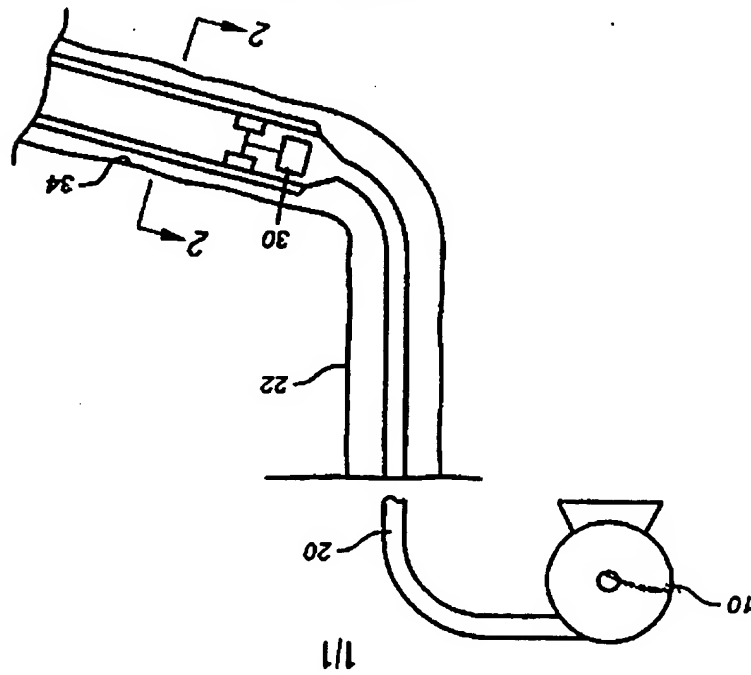


FIG. 1



2336383

TITLE: COILED TUBING SCREEN
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FIELD OF THE INVENTION

5 The field of this invention relates to downhole screens preferably deployed on coiled tubing where the tubing can also be expanded against the screen to push it against the wellbore.

BACKGROUND OF THE INVENTION

10 In typical completions in the past, metallic screens have been inserted on rigid or coiled tubing into a zone in the wellbore for production. Prior to producing the zone, sand particles were delivered outside the screen in a technique known as gravel packing. Screens have also been used that come prepacked with a sand layer as an alternative to the traditional gravel packing techniques or to be used in conjunction with the placement of sand outside the screen. The gravel packing procedures especially in horizontal completions left uncertainties as to whether the sand had been sufficiently distributed uniformly in the annular space so as to provide an effective gravel pack. Additionally, the gravel packing procedure took valuable time to accomplish and required the use of surface equipment to handle the material for placement in the wellbore. Another disadvantage of traditional gravel packing procedures is that an annular space around the screen had to be left so that the gravel could be placed there. The end result was the inside diameter within the screen was necessarily small to allow for the presence of the

One of the objects of the present invention is to allow a well to be produced through a screen without the need for a gravel pack. This objective is accomplished by the placement of an expandable screen that can move radially outwardly when placed at the desired location against the wellbore and be porous enough with sufficient open area to allow production from the formation. Another objective is to be able to easily place the screen in the desired location. This objective is met in one way by using coiled tubing which can be preperforated for a support for the screen. Another objective is to protect the screen during delivery to the desired location in the wellbore by

SUMMARY OF THE INVENTION

used to convey the gravel.

the formation as well as incompatibilities between the formation and the fluids that would allow fluid to convey the gravel to also apply hydraulic forces on formation in the gravel packing process, such as when situations occurred gap which would be gravel packed, further involved risks of damaging the formation which has just been drilled. Traditional techniques leaving an annular in its drilled state so as to create the least amount of disturbance to the formation and gravel packs being deployed.

cause subsequent plugging when the production began, even with screens formations, the drilling mud would form a barrier adjacent the wellbore which in using certain drilling techniques, particularly in unconsolidated production of the formation to the surface.

annular space. This constriction in size could also adversely affect the pro-

25 a tubular shape. The segment 12 can be rolled longitudinally so that edges
 proximately a 30 or 40 percent open area when the segment 12 is rolled into
 other known technique and in any order. The desirable goal is to have ap-
 20 12 can be punched for the holes 14 or the holes 14 can be placed there in any
 be arranged in any order either random or in repeating pattern. The segment
 As seen in Figure 4, segment 12 has a plurality of perforations 14 which can
 of which is preferably made from a perforated material as shown in Figure 4.
 coiled tubing reel 10 carries a continuous length of tubing 20, at least a portion
 The preferred embodiment is illustrated in operation in Figure 1. A

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

15 flexible tubing which gives underlying support to the filter or media.
 Figure 4 is a segment which can be rolled longitudinally or spirally into
 inner tube against the filtering material.
 Figure 3 is the section view of Figure 2 shown before expansion of the
 20 Figure 2 is the section view along lines 2-2 of Figure 1.
 thus expanded against the wellbore.
 Figure 1 is a sectional view of a deviated wellbore showing the appara-

BRIEF DESCRIPTION OF THE DRAWINGS

5 a providing a disposable or removable outer cover which can be disposed of
 after proper location of the screen in the wellbore. These and other objectives
 and the manner in which the apparatus and method accomplishes the objec-
 tives are further described below in the description of the preferred embodi-
 ment

16 and 18 are brought together to make a longitudinal seam which is welded or otherwise closed up. Alternatively, the segment 12 can be spirally wound so that edges 16 and 18 come together in a continuous spiral seam, with the advantage in spiral winding being that a particular outside diameter of a tubular configuration can be obtained with any given width of segment 12. This should be compared to rolling the segment 12 into a tube where its width determines the diameter of the tube that is formed when edges 16 and 18 are aligned and joined in a technique well known in the art.

The openings or holes 14 can be put on the tubing made from segment 12 for only a portion of the coiled tubing string 20. The segment 12 can be as long as the finished coiled length of the tubing 20 with openings 14 placed at the desired locations. Using conventional surface equipment and reel 10, the flexible tubing 20 can be quickly run into the wellbore 22 to place the perforated segment or segments at the desired locations.

Figure 2 shows in section the tube 20 made from the segment or segments 12 along with openings 14. Wrapped around the openings 14 is an opened grid structure which can be made from metallic or composite or other nonmetallic materials. The purpose of the grid 26 is to provide a support for the open cell filter media 28. In the preferred embodiment, the media 28 is made of Viton and is an open cell structure akin to a sponge material such as is available from Mosites Rubber Company of Fort Worth, Texas under Product No. 10292. The opening size can be made to suit. The significant feature of the filtering material 28 is that it is flexible. Thus, when the string 20 is preformed into a corrugated shape as shown in Figure 3, by using known techniques such as pulling it through a die, the filter material 28

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can then be applied over it as shown in Figure 3. Thereafter, when the material 28 is properly positioned in the wellbore, a known expansion tool illustrated schematically as 30 in Figure 1 can be inserted into the string 20 to take the initial shape shown in Figure 3 and expand the string 20 under the filter material 28 to a rounded shape as shown in Figure 2. As a result, the filter material which is flexible expands with the underlying tubular 20 as the shape of tubular 20 changes from that of Figure 3 to that of Figure 2.

A cover material 32 can overlay the filter material 28 for running in, so as to protect the filter material 28 from gauges or cuts during run-in. The material can be a thin sheet which snaps upon the slightest expansion of the corrugated tubular 20. It can be a elastomeric material that literally rips at the slightest expansion of the underlying corrugated tubular 20 as shown in Figure 3. Other materials for the cover 32 can be employed without departing from the spirit of the invention or, in a particular application, the cover itself can be eliminated. A material which dissolves or is chemically attacked over time can also be employed as a cover 32 such that it will no longer be in the way when it is desired to put the well in production.

Significant expansions volumetrically can be obtained in changing the shape of the tubular 20 from the corrugated shape, such as shown for example in Figure 3 to the rounded shape as shown in Figure 2. While a particular four-lobe arrangement of the corrugated shape is shown in Figure 3, other initial shapes are within the purview of the invention. The significant thing is that the underlying support structure which comprises the corrugated segment of the string 20, as shown in Figure 3, is capable of volumetrically expanding so as to bring the filter material 28 into contact with the wellbore as drilled.

The initial corrugated shape also permits insertion in smaller wellbores. The initial shape does not have to be corrugated. It can be round and be expanded downhole.

This technique is particularly advantageous in under-balanced drilling where circulating mud is not used. In these situations, particularly where

shale is encountered, the advantage of this type of drilling can be retained by

use of the apparatus and method as described. The initial shape of the

wellbore is retained by the assembly when the string 20 is expanded under

the filter material 28 so as to push the filter material 28 up against the wellbore

34. In so doing, the formation can be allowed to flow through the filter mate-

rial 28 without the presence of an annular space around the outside of the

filter material. The traditional gravel packing is eliminated and the flow area

within the tubular 20 after it has been expanded to a rounded shape is larger

than it otherwise would have been using a traditional gravel pack which

requires the annular space for the gravel necessitating a smaller inside diam-

eter inside the screen.

It should be noted that it is within the purview of this invention to pro-

duce a formation through the use of a coiled tubing string such as 20 which

is perforated with openings or holes 14. A tubing string 20 so perforated with

openings 14 can be used in conjunction with traditional gravel pack tech-

niques to produce a formation. In the preferred embodiment, the open cell

filter material 28 preferably made of an elastic, preferably elastomeric material

such as Viton is overlaid on the corrugated tubular 20 as shown in Figure 3.

The stretchable qualities of the filter material 28 allow its use in conjunction

with an initially corrugated tube 20 as shown in Figure 3 or a noncorrugated

25 expand the combination against the wellbore. However, the preferred em-
cross section for the tube 20 under the filter material 28 and mechanically
it is also within the purview of the invention to use an initially round
ployed without departing from the spirit of the invention.

20 28. The reinforcement 26 can be made from metallic and nonmetallic materi-
als and is generally an open weave. However, other structures can be em-
shown in Figure 2, or it can be a structural component within the filter material
The reinforcing grid 26 can be a layer that overlays the tube 20 as
production from the formation.

15 filter material 28 around it act as a perforated casing for the purposes of
position, as shown in Figure 2. Upon expansion, the tube material 20 with the
ing sizes and holds the formation in its natural state when in the expanded
The use of a flexible material for the filter material 28 gives predictable open-
Various known techniques to expand the base pipe 20 can be used.
against the wellbore.

10 assembly can be expanded in an initial rounded state to push material 28
without initially corrugating the tube 20 under the filter material 28. This
28 over a coiled tubing such as 20 which is perforated with holes 14
It is also within the purview of the invention to provide a filter material
proper depth.

5 20 in the perforated area sufficient column strength to be advanced to the
areas in tube 20 can be as high as 20 to 40 percent while still giving the tube
not expand substantially when the base pipe 20 expands. Additionally, open
rial 28 when expanded to its rounded form. The openings in material 28 do
tube, and allow tube 20 to act as a sufficiently rigid support for the filter mate-

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bodiment involves the use of a corrugated tube under filter 28 material so that
 greater volumetric expansions can occur underneath the filter material 28 to
 better position it against the wellbore.
 In the preferred embodiment, the openings 14 are round. Rounded
 openings provide a better structural integrity of the tube after expansion than
 initial openings which are slotted. Using materials such as stainless steel
 316L, yield strengths of 30,000 to 80,000 psi can be obtained.
 It is also within the scope of the invention to provide a sufficient expan-
 sion force on the corrugated tube 20 to get it into the rounded position shown
 in Figure 2 such that the filter 28 engages the wellbore with a residual force
 and, in certain conditions, pushes back the formation materials defining the
 wellbore to enlarge it.
 The expansion techniques which are known can be used to change the
 configuration of the corrugated tube 20 under the filter material 28 to a
 rounded shape. These can include devices which employ a wedge which is
 pushed or pulled through the tubular or any other driving device which entails
 the use of rollers which can be actuated radially outwardly to initiate the
 expansion of the corrugated tubular as the driver advances.
 Those skilled in the art will appreciate the advantages of the apparatus
 and method as described above. In lateral completions there is some uncer-
 tainty as to the distribution of the gravel around a screen. Additionally, the
 necessity of leaving an annular gap for placement of the gravel acts as a
 limitation on production from the zone in the wellbore. In certain applications
 involving unconsolidated shale formations, drilling with mud can create an
 impervious cake on the wellbore walls which will be detrimental to future

production when used with traditional gravel packing techniques. Accordingly, it is as close to its natural state as possible, the concept of producing through coiled tubing with the apparatus and method as described greatly enhances the production possible from the formation. Accordingly, an open cell filtering material such as 28 which can be stretched is preferred in combination with an underlying coiled tubing material which can be expanded from the constricted initial condition to a rounded final condition. The open cell filter material 28 can be pushed firmly against the formation where it can easily resist longitudinal flow due to the small pressure increments involved in flow in that direction. The opening size in the filter material 28 is predictable and the assembly can be protected for delivery to the desired location with the cover structure eliminated prior to or during the expansion of the filter material 28 with the underlying tube 20 below it. While various types of mechanical expansions of the underlying tube 20 from a constricted state to a rounded state have been described, other techniques to push the filter material 28 against the wellbore while supporting it with an underlying perforated support pipe having a large open area, in the order of 20 to 40 percent, are also in the purview of the invention. The reinforcing layer which can be between the tube and the filter material 28, or within the filter material 28, prevents extrusion of the filter material 28 through the openings 14 in the base pipe or tube 20, as shown in Figure 2.

The foregoing disclosure and description of the invention are illustrative and explanatory thereof, and various changes in the size, shape and materi-

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References are made to the drawings as follows:

also, as well as in the details of the illustrated construction, may be made without departing from the spirit of the invention.

<u>CLAIMS</u>	
1. A wellbore completion tool assembly, comprising: a perforated body made of an expandable material; a filter assembly mounted over said perforated body so as to cover the perforations in said body; a tool acting on said body to expand it and said filter mounted around it to allow said filter to move toward the surface defining the wellbore.	1
2. The assembly of claim 1, further comprising: a protective cover for said filter assembly which is removable downhole.	1 2 3
3. The assembly of claim 1, wherein: said expandable material is corrugated to facilitate insertion into the wellbore, whereupon said tool expands said corrugations to move said filter toward the surface defining the wellbore.	1 2 3 4
4. The assembly of claim 3, wherein: said body assumes a rounded shape after expansion by said tool	1 2
5. The assembly of claim 1, further comprising: a reinforcement between said body and said filter assembly to support said filter assembly in the area of said body perforations.	1 2 3

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1	6.	The assembly of claim 1, wherein:	1
2		said perforated body comprises a segment of a coiled tubing	2
3		string.	3
1	7.	The assembly of claim 6, wherein:	1
2		said segment has an open area in the range of up to about 40%.	2
1	8.	The assembly of claim 6, wherein:	1
2		said segment is flexible.	2
1	9.	The assembly of claim 6, wherein:	1
2		said segment is made from a flat member which is rolled into a	2
3		tube with a sealed longitudinal joint.	3
1	10.	The assembly of claim 6, wherein:	1
2		said segment is made from a flat member and rolled spirally to	2
3		a desired diameter having its spiral seam sealed.	3
1	11.	The assembly of claim 3, wherein:	1
2		said perforated body comprises a segment of a coiled tubing	2
3		string.	3
1	12.	The assembly of claim 11, further comprising:	1
2		a reinforcement between said body and said filter assembly to	2
3		support said filter assembly in the area of said body perforations.	3

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13.	1	The assembly of claim 12, further comprising:
	2	a protective cover for said filter assembly which is removable
	3	downhole.
14.	1	A method of well completion, comprising:
	2	running in a tubular body with perforations and a filter assembly
	3	mounted over the perforations on the body;
	4	expanding the tubular body downhole.
15.	1	The method of claim 14, further comprising:
	2	providing a protective covering over the filter assembly for run-in;
	3	removing the protective covering downhole.
16.	1	The method of claim 14, further comprising:
	2	conjugating said tubular body;
	3	altering said conjugating into a rounded shape by virtue of said
	4	expanding.
17.	1	The method of claim 14, further comprising:
	2	engaging the wellbore with the filter assembly due to said ex-
	3	panding;
	4	using a segment of coiled tubing as said tubular body.

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under/underneath said being arranged as

- | | | |
|-----|--|---|
| 18. | The method of claim 14, further comprising: | 1 |
| | providing a support between said tubular body and said filter | 2 |
| | assembly. | 3 |
| 19. | The method of claim 14, further comprising: | 1 |
| | providing an open area on said tubular body of up to about 40%. | 2 |
| 20. | The method of claim 17, further comprising: | 1 |
| | corrugating said tubular body; | 2 |
| | altering said corrugating into a rounded shape by virtue of said | 3 |
| | expanding. | 4 |

21. A wellbore completion assembly comprising an expandable porous downhole screen.

22. A wellbore completion assembly as claimed in claim 21, wherein said screen comprises a filter material which, in use, is radially expanded towards the wellbore.

23. A wellbore completion assembly as claimed in claim 22, wherein the screen, in use, is expanded so as to push the filter material directly against the wellbore.

24. A wellbore completion assembly as claimed in claim 22 or 23, wherein the filter material is flexible.

25. A wellbore completion assembly as claimed in any of claims 21-24, wherein said screen is disposed on coiled tubing.

26. A wellbore completion assembly as claimed in claim 25, wherein at least a portion of said coiled tubing is perforated.

27. A wellbore completion assembly as claimed in claim 25 or 26, wherein said coiled tubing is expanded, in use, thereby expanding said screen.

28. A wellbore completion assembly as claimed in claim 26 or 27, further comprising a reinforcing grid between at least part of said filter material and at least part of the perforated portion of said coiled tubing, said reinforcing grid substantially preventing extrusion of said filter material through said perforated coiled tubing.

29. A wellbore completion assembly as claimed in any of claims 25-28, wherein at least a portion of said coiled tubing is initially corrugated in shape.

30. A wellbore completion assembly as claimed in any of claims 21-29, further comprising a disposable or removable outer cover for protecting said screen during delivery downhole.

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31. A wellbore completion tool assembly substantially as hereinafore described with reference to the accompanying drawings.

10 32. A method of well completion substantially as hereinafore described with reference to the accompanying drawings.

INVENTOR IN PEOPLE



The Patent Office

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Application No: GB 9908521.9
Claims searched: 1-32
Examiner: Ben Mickelwright
Date of search: 4 June 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:
UK CI (Ed.Q): EIP (PT)
Int CI (Ed.6): E21B (43/02 43/08 43/10)
Other: Online: EP/ODOC

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X,P	WO 98/49423 A1 (SHELT) See whole document	1,2-6 8,14,15,17 19,21 27,30
X,Y	WO 97/17524 A1 (SHELT) See whole document, e.g. page 2 lines 11-33, page 6 lines 27-31 and the figures	X: 1-6 8,14,17,19 21-27 Y: 2,15,30
Y	US 5 310 000 (HALLIBURTON) See whole document, e.g. column 3 lines 30-54 and the figures	2,15,30
X,Y	US 4 484 626 (K-V) See e.g. column 2 line 53 to column 3 line 11 and the figures	X: 21-24 Y: 30

X	Document indicating lack of novelty or inventive step
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.
A	Document indicating technological background and/or state of the art.
P	Document published on or after the declared priority date but before the filing date of the invention.
Z	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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